CERTIFICATE

I, Hisako Ito, residing at 4-35-13, Takadanobaba, Shinjuku-ku, Tokyo, Japan, hereby certify that I am the translator of the attached document, namely a Certified Copy of Japanese Patent Application 8-248087 and certify that the following is a true translation to the best of my knowledge and belief.

Hisako Ito — March 14, 2002

Signature of Translator — Date

[Name of Document] Application for Patent

[Reference No.] POS56176

[Date of Filing] September 19, 1996

[Addressee] Commissioner of the Patent Office

[Int. Cl.] G02F 1/13

[Title of the Invention]

Method of Manufacturing Matrix Type Display Device

[Number of Claims] 43

[Inventor]

[Address] c/o Seiko Epson Corporation,
3-5, Owa 3-chome, Suwa-shi, Nagano-ken

[Name] Mutsumi Kimura

[Inventor]

[Address] c/o Seiko Epson Corporation,
3-5, Owa 3-chome, Suwa-shi, Nagano-ken

[Name] Hiroshi Kiguchi

[Applicant for Patent]

[Id. No.] 000002369

[Name] Seiko Epson Corporation

[Representative] Hideaki Yasukawa

[Agent]

[Id. No.] 100093388

[Patent Attorney]

[Name] Kisaburo Suzuki

[Contact] 3348-8531 extension 2610-2615

[Sub-agent]

[Id. No.] 100095728

[Patent Attorney]

[Name] Masataka Kamiyangi

[Sub-agent]

[Id. No.] 100107261

[Patent Attorney]

[Name] Osamu Suzawa

[Application Fees]

[Prepayment Registration No.] 013044

[Amount of Payment] 21000

[List of Documents Attached]

[Name of Document]	Specification	1
[Name of Document]	Drawings	1
[Name of Document]	Abstract	1

[No. of General Power of Attorney] . 9603594

[Proof] Required

[Name of Document] SPECIFICATION

[Title of the Invention]

Method of Manufacturing Matrix Type Display Device

[Claims]

[Claim 1] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming unevenness on the display substrate; and

coating the optical material in correspondence with the unevenness.

[Claim 2] The method of manufacturing a matrix type display device according to Claim 1, wherein the optical material is coated in correspondence with recesses of the unevenness.

[Claim 3] The method of manufacturing a matrix type display device according to Claim 1, wherein the optical material is coated in correspondence with protrusions of the unevenness.

[Claim 4] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a plurality of first bus lines on the display substrate;

forming unevenness;

coating the optical material in correspondence with the unevenness; and

forming a plurality of second bus lines so that the second bus lines cross the first bus lines at right angles.

[Claim 5] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a plurality of first bus lines on the display substrate;

forming unevenness;

coating the optical material in correspondence with the unevenness;

forming a plurality of second bus lines on a peeling substrate through a peeling layer;

transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate so that the first bus lines cross the second bus lines at right angles.

[Claim 6] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical

In this claim, in an active matrix type display device, the patterning precision can be improved.

[0019]

(7) In accordance with Claim 7, the present invention relates a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming unevenness on the display substrate, coating the optical material in correspondence with the unevenness, forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines, and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines on a peeling substrate through a peeling layer, and transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate.

[0020]

In this claim, in an active matrix type display device, it is possible to decrease damage to a base material such as the optical material or the like in later steps, or damage to the scanning lines, the signal lines, the pixel electrodes or the switching elements due to coating of the

material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines, switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines on the display substrate;

forming unevenness; and

coating the optical material in correspondence with the unevenness.

[Claim 7] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming unevenness on the display substrate;

coating the optical material in correspondence with the unevenness;

forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines, switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential

of the scanning lines on a peeling substrate through a peeling layer; and

transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate.

[Claim 8] The method of manufacturing a matrix type display device according to Claim 4 or 5, wherein the unevenness is formed by utilizing the first bus lines.

[Claim 9] The method of manufacturing a matrix type display device according to Claim 6, wherein the unevenness is formed by utilizing the scanning lines, the signal lines, or common lines formed on the display substrate.

[Claim 10] The method of manufacturing a matrix type display device according to Claim 6, wherein the unevenness is formed by utilizing the pixel electrodes.

[Claim 11] The method of manufacturing a matrix type display device according to Claim 4, 5, 6 or 7, wherein the unevenness is formed by utilizing an insulation film.

[Claim 12] The method of manufacturing a matrix type display device according to Claim 4, 5, 6 or 7, wherein the unevenness is formed by utilizing a light shielding layer.

[Claim 13] The method of manufacturing a matrix type display device according to Claim 1, wherein the unevenness is formed by coating a liquid material.

[Claim 14] The method of manufacturing a matrix type display device according to Claim 1, wherein the unevenness

forms a material on a peeling substrate through a peeling layer; and

the structure peeled off from the peeling layer on the peeling substrate is transferred onto the display substrate.

[Claim 15] The method of manufacturing a matrix type display device according to Claim 1, wherein the difference in height of the unevenness satisfies the following equation (1):

Equation (1)

$$da < dr$$

wherein the symbols represent the following:

da: coating thickness of the liquid optical material

dr: difference in height of the unevenness

[Claim 16] The method of manufacturing a matrix type display device according to Claim 15, wherein the coating thickness satisfies the following equation (2):

Equation (2)

$$Vd/(da \cdot r) > Et$$

wherein the symbols represent the following:

Vd: driving voltage applied to the optical material

r: concentration of the liquid optical material

Et: minimum electric field strength (threshold electric field strength) at which changes in properties of the optical material occur

[Claim 17] The method of manufacturing a matrix type

display device according to Claim 1, wherein the difference in height of the unevenness satisfies the following equation (3):

Equation (1)

$$df = dr$$

wherein the symbols represent the following:

df: thickness of the optical material at the time of completion

dr: difference in height of the unevenness

[Claim 18] The method of manufacturing a matrix type display device according to Claim 17, wherein the thickness at the time of completion satisfies the following equation (4):

Equation (4)

$$Vd/df > Et$$

wherein the symbols represent the following:

Vd: driving voltage applied to the optical material

Et: minimum electric field strength (threshold electric field strength) at which changes in properties of the optical material occur

[Claim 19] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a distribution of liquid repellency and lyophilicity for the liquid on the display substrate; and

coating the optical material in correspondence with the distribution of liquid repellency and lyophilicity.

[Claim 20] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a plurality of first bus lines on the display substrate;

forming a distribution of liquid repellency and lyophilicity for the liquid;

coating the optical material in correspondence with the distribution of liquid repellency and lyophilicity; and

forming a plurality of second bus lines so that the second bus lines cross the first bus lines at right angles.

[Claim 21] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a plurality of first bus lines on the display substrate;

forming a distribution of liquid repellency and

lyophilicity for the liquid;

coating the optical material in correspondence with the distribution of liquid repellency and lyophilicity;

forming a plurality of second bus lines on a peeling substrate through a peeling layer; and

transferring the structure peeled off from the peeling layer on the peeling substrate so that the first bus lines cross the second bus lines at right angles.

[Claim 22] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines, and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines on the display substrate;

forming a distribution of liquid repellency and lyophilicity for the liquid; and

coating the optical material in correspondence with the distribution of liquid repellency and lyophilicity.

[Claim 23] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution)

optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a distribution of liquid repellency and lyophilicity for the liquid on the display substrate;

coating the optical material in correspondence with the distribution of liquid repellency and lyophilicity;

forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines, and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines on a peeling substrate through a peeling layer; and

transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate.

[Claim 24] The method of manufacturing a matrix type display device according to Claim 20 or 21, wherein the distribution of liquid repellency and lyophiicity is formed by utilizing the first bus lines.

[Claim 25] The method of manufacturing a matrix type display device according to Claim 22, wherein the distribution of liquid repellency and lyophilicity is formed by utilizing the scanning lines, the signal lines, or common lines formed on the display substrate.

[Claim 26] The method of manufacturing a matrix type display device according to Claim 22, wherein the distribution of liquid repellency and lyophilicity is formed by utilizing the pixel electrodes.

[Claim 27] The method of manufacturing a matrix type display device according to Claim 20, 21, 22 or 23, wherein the unevenness is formed by utilizing an insulation film.

[Claim 28] The method of manufacturing a matrix type display device according to Claim 20, 21, 22 or 23, wherein the unevenness is formed by utilizing a light shielding layer.

[Claim 29] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a potential distribution on the display substrate; and

coating the optical material in correspondence with the potential distribution.

[Claim 30] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a potential distribution on the display substrate;

charging the optical material; and

coating the optical material in correspondence with the potential distribution.

[Claim 31] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a plurality of first bus lines on the display substrate;

forming a potential distribution;

coating the optical material in correspondence with the potential distribution; and

forming a plurality of second bus lines so that the second bus lines cross the first bus lines at right angles.

[Claim 32] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a plurality of first bus lines on the display substrate;

forming a potential distribution;

coating the optical material in correspondence with the potential distribution;

forming a plurality of second bus lines on a peeling substrate through a peeling layer; and

transferring the structure peeled off from the peeling layer on the peeling substrate so that the first bus lines cross the second bus lines at right angles.

[Claim 33] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to on the intersections of the scanning lines and the signal lines, and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines on the display substrate;

forming a potential distribution; and

coating the optical material in correspondence with the potential distribution.

[Claim 34] A method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation

material) is coated on a display substrate, the method comprising:

forming a potential distribution on the display substrate;

coating the optical material in correspondence with the potential distribution;

forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to on the intersections of the scanning lines and the signal lines, and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines on a peeling substrate through a peeling layer; and

transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate.

[Claim 35] The method of manufacturing a matrix type display device according to Claim 31 or 32, wherein the potential distribution is formed by applying a potential to the first bus lines.

[Claim 36] The method of manufacturing a matrix type display device according to Claim 33, wherein the potential distribution is formed by applying a potential to the scanning lines, the signal lines or the common lines formed on the display substrate.

[Claim 37] The method of manufacturing a matrix type

display device according to Claim 33, wherein the potential distribution is formed by applying a potential to the pixel electrodes.

[Claim 38] The method of manufacturing a matrix type display device according to Claim 37, wherein the potential distribution is formed by successively applying a potential to the scanning lines, and at the same time applying a potential to the signal lines, and applying a potential to the pixel electrodes through the switching elements.

[Claim 39] The method of manufacturing a matrix type display device according to Claim 31, 32, 33 or 34, wherein the potential distribution is formed by applying a potential to a light shielding layer.

[Claim 40] The method of manufacturing a matrix type display device according to Claim 29, wherein the potential distribution is formed so that a region coated with the optical material has polarity opposite to that of a region not coated or coated with the optical material during another period of time.

[Claim 41] The method of manufacturing a matrix type display device according to Claim 1, 19 or 29, wherein the optical material is an inorganic or organic fluorescent material.

[Claim 42] The method of manufacturing a matrix type display device according to Claim 1, 19 or 29, wherein the

optical material is a liquid crystal.

[Claim 43] The method of manufacturing a matrix type display device according to Claim 6, 7, 22, 23, 33 or 34, wherein the switching elements are made of amorphous silicon, polycrystalline silicon formed by a high temperature process at 600° C or more, or polycrystalline silicon formed by a low temperature process at 600° C or less.

[Detailed Description of the Invention]

[0001]

[Industrial Field of the Invention]

The present invention relates to a method of manufacturing a matrix type display device, and particularly to a method of manufacturing a matrix type display device comprising coating a liquid optical material.

[0002]

[Description of the Related Art]

Many matrix type display devices with many varieties are used as display devices which allow the realization of light weight, thinning, high quality and high definition. A matrix type display device comprises bus lines in a matrix form, an optical material (a luminescent material or light modulation material), and if required, other components. In some cases, the optical material is patterned for each of pixels respectively corresponding to the intersections of the bus lines. Examples of pattering methods include

etching and coating.

[0003]

The etching process is carried out as follows. First, the optical material is coated over the entire surface of a display substrate. Next, a resist is formed and patterned by exposure. Then the optical material is patterned by etching corresponding to the resist pattern. In this case, since a large number of steps are required, and each of the materials and apparatus is expensive, the cost is increased. In addition, since a large number of steps are required, and each of the steps is complicated, the throughput is low. Further, depending upon chemical properties, some optical materials have low resistance to a resist and an etchant, and thus these steps are impossible.

[0004]

On the other hand, the coating process is carried out as follows. First, the liquid (a liquid or solution) optical material is selectively coated on the display device by an ink jet method. Then the optical material is solidified by heating, light irradiation or the like according to demand. In this case, since only a small number of steps are required, and each of the materials and apparatus is inexpensive, the cost is low. In addition, since only a small number of steps are required, and each of the steps is simple, the throughput is high. These steps

are possible as long as the optical material can be liquefied regardless of the chemical properties thereof.

[0005]

[Problems to be Solved by the Invention]

The method of manufacturing a matrix type display device comprising coating a liquid optical material has the following problem, as compared with etching. Namely, the pattering precision is poor due to the fluidity of the liquid optical material. For example, the optical material coated on a pixel flows out to the adjacent pixels, thereby deteriorating the optical properties of the pixels. Also, variations occur in the coating areas in the respective pixels, and thus variations occur in the coating thickness and in the optical properties of the optical material.

[0006]

Accordingly, an object of the present invention is to improve the pattering precision while maintaining characteristics such as low cost, high throughput, and the high degree of freedom of an optical material in a method of manufacturing a matrix type display device comprising coating a liquid optical material.

[0007]

[Means for Solving the Problems]

(1) In accordance with Claim 1, the present invention relates a method of manufacturing a matrix type display

device in which a liquid (a liquid or solution) optical material is coated on a display substrate, comprising forming unevenness on the display substrate, and coating the optical material in correspondence with the unevenness.

[0008]

In this claim, the method of manufacturing a matrix type display device comprising coating a liquid optical material can improve the patterning precision while maintaining characteristics such as low cost, high throughput and the high degree of freedom of the optical material.

[0009]

(2) In accordance with Claim 2, the present invention relates to the method of manufacturing a matrix type display device according to Claim 1 wherein the optical material is coated in correspondence with the recesses of the unevenness.

[0010]

In this claim, the patterning precision can be improved by using gravity, inertia force, surface tension or the like.

[0011]

(3) In accordance with Claim 3, the present invention relates the method of manufacturing a matrix type display device according to Claim 1 wherein the optical material is coated in correspondence with the protrusions of the unevenness.

[0012]

In this claim, the patterning precision can be improved by using gravity, inertia force, surface tension or the like.

[0013]

(4) In accordance with Claim 4, the present invention relates a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a plurality of first bus lines on the display substrate, forming unevenness, coating the optical material in correspondence with the unevenness, and forming a plurality of second bus lines so that the second bus lines cross the first bus lines at right angles.

[0014]

In this claim, in a passive matrix type display device, the patterning precision can be improved.

[0015]

(5) In accordance with Claim 5, the present invention relates a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a plurality of first bus lines on the display substrate, forming unevenness, coating the optical

material in correspondence with the unevenness, forming a plurality of second bus lines on a peeling substrate through a peeling layer, and transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate so that the first bus lines cross the second bus lines at right angles.

[0016]

In this claim, in a passive matrix type display device, it is possible to decrease damage to a base material such as the optical material or the like in later steps.

[0017]

(6) In accordance with Claim 6, the present invention relates a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming on a display substrate a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines, and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines, forming unevenness, and coating the optical material in correspondence with the unevenness.

[0018]

optical material.

[0021]

(8) In accordance with Claim 8, the present invention relates to the method of manufacturing a matrix type display device according to Claim 4 or 5, wherein the unevenness is formed by utilizing the first bus lines.

[0022]

In this claim, since the unevenness is formed by utilizing the first bus lines, an increase in number of the steps can be suppressed.

[0023]

(9) In accordance with Claim 8, the present invention relates to the method of manufacturing a matrix type display device according to Claim 6, wherein the unevenness is formed by utilizing the scanning lines, the signal lines or the common lines formed on the display substrate.

[0024]

In this claim, since the unevenness is formed by utilizing the scanning line, the signal line or the common lines, an increase in number of the steps can be suppressed.

[0025]

(10) In accordance with Claim 10, the present invention relates to the method of manufacturing a matrix type display device according to Claim 6, wherein the unevenness is formed by utilizing the pixel electrodes.

[0026]

In this claim, since the unevenness is formed by utilizing the pixel electrodes, an increase in number of the steps can be suppressed.

[0027]

(11) In accordance with Claim 11, the present invention relates to the method of manufacturing a matrix type display device according to Claim 4, 5, 6 or 7, wherein the unevenness is formed by utilizing an insulation film.

[0028]

In this claim, since the unevenness is formed by utilizing the insulation film, an increase in number of the steps can be suppressed.

[0029]

(12) In accordance with Claim 12, the present invention relates to the method of manufacturing a matrix type display device according to Claim 4, 5, 6 or 7, wherein the unevenness is formed by utilizing a light shielding layer.

[0030]

In this claim, since the unevenness is formed by utilizing the light shielding layer, an increase in number of the steps can be suppressed.

[0031]

(13) In accordance with Claim 13, the present invention relates to the method of manufacturing a matrix type display

device according to Claim 1, wherein the unevenness is formed by coating a liquid material.

[0032]

In this claim, it is possible to simplify the step of forming the unevenness, and form the unevenness having a large difference in height while decreasing damage to a base material.

[0033]

(14) In accordance with Claim 14, the present invention relates to the method of manufacturing a matrix type display device according to Claim 1, wherein the unevenness forms a material on a peeling substrate through a peeling layer, and the structure peeled off from the peeling layer on the peeling substrate is transferred onto the display substrate.

[0034]

In this claim, it is possible to simplify the step of forming the unevenness, and form the unevenness having a large difference in height while decreasing damage to the base material.

[0035]

(15) In accordance with Claim 15, the present invention relates to the method of manufacturing a matrix type display device according to Claim 1, wherein the difference in height of the unevenness satisfies the following equation (1):

[0036]

Equation (1), $da < dr$, wherein the symbols in the equation represent the following:

da: coating thickness of the liquid optical material

dr: difference in height of unevenness

In this claim, the liquid optical material can be prevented from flowing out to adjacent regions beyond the unevenness during coating of the liquid optical material.

[0037]

(16) In accordance with Claim 16, the present invention relates to the method of manufacturing a matrix type display device according to Claim 15, wherein the coating thickness satisfies the following equation (2):

[0038]

Equation (2), $Vd/(Da \cdot r) > Et$, wherein the symbols represent the following:

Vd: driving voltage applied to the optical material

r: concentration of the liquid optical material

Et: minimum electric field strength (threshold electric field strength) at which changes in optical properties of the optical material occur

In this claim, the relation between the coating thickness and the driving voltage is defined, and it is ensured that the optical material exhibits an electro-optical effect.

[0039]

(17) In accordance with Claim 17, the present invention relates to the method of manufacturing a matrix type display device according to Claim 1, wherein the difference in height of the unevenness satisfies the following equation (3):

[0040]

Equation (3), $df = dr$, wherein the symbols represent the following:

df: thickness of the optical material at the time of completion

dr: difference in height of unevenness

In this claim, flatness of the unevenness and the optical material is ensured, changes in the optical properties of the optical material are made uniform, and a short circuit can be prevented.

[0041]

(18) In accordance with Claim 18, the present invention relates to the method of manufacturing a matrix type display device according to Claim 17, wherein the thickness at the time of completion satisfies the following equation (4):

[0042]

Equation (4), $Vd/df > Et$, wherein the symbols represent the following:

Vd: driving voltage applied to the optical material

Et: minimum electric field strength (threshold electric field strength) at which changes in the optical properties of the optical material occur

In this claim, the relation between the thickness at the time of completion and the driving voltage is defined, and it is ensured that the optical material exhibits an electro-optical effect.

[0043]

(19) In accordance with Claim 19, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising:

forming a distribution of liquid repellency and lyophilicity for the liquid, and coating the optical material in correspondence with the distribution of liquid repellency and lyophilicity.

[0044]

In this claim, the method of manufacturing a matrix type display device can improve the patterning precision while maintaining properties such as low cost, high throughput, the high degree of freedom of the optical material, etc.

[0045]

(20) In accordance with Claim 20, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a plurality of first bus lines on the display substrate, forming a distribution of liquid repellency and lyophilicity for the liquid, coating the optical material in correspondence with the distribution of liquid repellency and lyophilicity, and forming a plurality of second bus lines so that the second bus lines cross the first bus lines at right angles.

[0046]

In this claim, in a passive matrix type display device, the patterning precision can be improved.

[0047]

(21) In accordance with Claim 21, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a plurality of first bus lines on the display substrate, forming a distribution of liquid repellency and lyophilicity for the liquid, coating the optical material in correspondence with the distribution of

liquid repellency and lyophilicity, forming a plurality of second bus lines on a peeling substrate through a peeling layer, and transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate so that the first bus lines cross the second bus lines at right angles.

[0048]

In this claim, in a passive matrix type display device, it is possible to decrease damage to a base material such as the optical material or the like in later steps.

[0049]

(22) In accordance with Claim 22, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming on the display substrate a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines, forming a distribution of liquid repellency and lyophilicity for the liquid, and coating the optical material in correspondence with the distribution of liquid

repellency and lyophilicity.

[0050]

In this claim, in an active matrix type display device, the patterning precision can be improved.

[0051]

(23) In accordance with Claim 23, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a distribution of liquid repellency and lyophilicity for the liquid on the display substrate, coating the optical material in correspondence with the distribution of liquid repellency and lyophilicity, forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines, and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines on a peeling substrate through a peeling layer, and transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate.

[0052]

In this claim, in an active matrix type display device,

it is possible to decrease damage to the base material such as the optical material or the like in later steps, or damage to the scanning lines, the signal lines, the pixel electrodes or the switching elements due to coating of the optical material.

[0053]

(24) In accordance with Claim 24, the present invention relates to the method of manufacturing a matrix type display device according to Claim 20 or 21, wherein the distribution of liquid repellency and lyophilicity is formed by utilizing the first bus lines.

[0054]

In this claim, since the distribution of liquid repellency and lyophilicity is formed by utilizing the first bus lines, an increase in the number of the steps can be prevented.

[0055]

(25) In accordance with Claim 25, the present invention relates to the method of manufacturing a matrix type display device according to Claim 22, wherein the distribution of liquid repellency and lyophilicity is formed by utilizing the scanning lines, the signal lines or the common lines formed on the display substrate.

[0056]

In this claim, since the distribution of liquid

repellency and lyophilicity is formed by utilizing the scanning lined, the signal lines or the common lines, an increase in the number of the steps can be prevented.

[0057]

(26) In accordance with Claim 26, the present invention relates to the method of manufacturing a matrix type display device according to Claim 22, wherein the distribution of liquid repellency and lyophilicity is formed by utilizing the pixel electrodes.

[0058]

In this claim, since the distribution of liquid repellency and lyophilicity is formed by utilizing the pixel electrodes, an increase in the number of the steps can be prevented.

[0059]

(27) In accordance with Claim 27, the present invention relates to the method of manufacturing a matrix type display device according to Claim 20, 21, 22 or 23, wherein the distribution of liquid repellency and lyophilicity is formed by utilizing an insulation film.

[0060]

In this claim, since the distribution of liquid repellency and lyophilicity is formed by utilizing the insulation film, an increase in the number of the steps can be prevented.

[0061]

(28) In accordance with Claim 28, the present invention relates to the method of manufacturing a matrix type display device according to Claim 20, 21, 22 or 23, wherein the distribution of liquid repellency and lyophilicity is formed by utilizing a light shielding layer.

[0062]

In this claim, since the distribution of liquid repellency and lyophilicity is formed by utilizing the light shielding layer, an increase in the number of the steps can be prevented.

[0063]

(29) In accordance with Claim 29, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a potential distribution on the display substrate, and coating the optical material in correspondence with the potential distribution.

[0064]

In this claim, the method of manufacturing a matrix type display device comprising coating the liquid optical material can improve the patterning precision while maintaining characteristics such as low cost, high

throughput, the high degree of freedom of the optical material, etc.

[0065]

(30) In accordance with Claim 30, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a potential distribution on the display substrate, charging the optical material, and coating the optical material in correspondence with the potential distribution.

[0066]

In this claim, the effect of improving the patterning precision is further increased by utilizing not only spontaneous polarization but also electric charge.

[0067]

(31) In accordance with Claim 31, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a plurality of first bus lines on the display substrate, forming a potential distribution, coating the optical material in correspondence with the potential

distribution, and forming a plurality of second bus lines so that the second bus lines cross the first bus lines at right angles.

[0068]

In this claim, in a passive matrix type display device, the patterning precision can be improved.

[0069]

(32) In accordance with Claim 32, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a plurality of first bus lines on the display substrate, forming a potential distribution, coating the optical material in correspondence with the potential distribution, forming a plurality of second bus lines on a peeling substrate through a peeling layer, and transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate so that the first bus lines cross the second bus lines at right angles.

[0070]

In this claim, in a passive matrix display device, it is possible to decrease damage to the base material such as the optical material or the like in later steps.

[0071]

(33) In accordance with Claim 33, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines, and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines on the display substrate, forming a potential distribution, and coating the optical material in correspondence with the potential distribution.

[0072]

In this claim, in a passive matrix type display device, the patterning precision can be improved.

[0073]

(34) In accordance with Claim 34, the present invention relates to a method of manufacturing a matrix type display device in which a liquid (a liquid or solution) optical material (a luminescent material or light modulation material) is coated on a display substrate, the method comprising forming a potential distribution on the display substrate, coating the optical material in correspondence

with the potential distribution, forming a plurality of scanning lines, a plurality of signal lines, pixel electrodes respectively corresponding to the intersections of the scanning lines and the signal lines, and switching elements for controlling conduction between the signal lines and the pixel electrodes by using the potential of the scanning lines on a peeling substrate through a peeling layer, and transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate.

[0074]

In this claim, in an active matrix display device, it is possible to decrease damage to a base material such as the optical material or the like in later steps, or damage to the scanning lines, the signal lines, the pixel electrodes or the switching elements. due to coating of the optical material.

[0075]

(35) In accordance with Claim 35, the present invention relates to the method of manufacturing a matrix type display device according to Claim 31 or 32, wherein the potential distribution is formed by applying a potential to the first bus lines.

[0076]

In this claim, since the potential distribution is

formed by utilizing the first bus lines, it is possible to suppress an increase in the number of the steps.

[0077]

(36) In accordance with Claim 36, the present invention relates to the method of manufacturing a matrix type display device according to Claim 33, wherein the potential distribution is formed by applying a potential to the scanning lines, the signal lines or the common lines formed on the display substrate.

[0078]

In this claim, since the potential distribution is formed by utilizing the scanning lines, signal lines or the common lines, it is possible to suppress an increase in the number of the steps.

[0079]

(37) In accordance with Claim 37, the present invention relates to the method of manufacturing a matrix type display device according to Claim 33, wherein the potential distribution is formed by applying a potential to the pixel electrodes.

[0080]

In this claim, since the potential distribution is formed by utilizing the pixel electrodes, it is possible to suppress an increase in the number of the steps.

[0081]

(38) In accordance with Claim 38, the present invention relates to the method of manufacturing a matrix type display device according to Claim 37, wherein the potential distribution is formed by successively applying a potential to the scanning lines, and at the same time applying a potential to the signal lines, and applying a potential to the pixel electrodes through the switching elements.

[0082]

In this claim, a potential can be applied to the pixel electrodes which can be turned on only through the switching elements.

[0083]

(39) In accordance with Claim 39, the present invention relates to the method of manufacturing a matrix type display device according to Claim 31, 32, 33 or 34, wherein the potential distribution is formed by applying a potential to a light shielding layer.

[0084]

In this claim, since the potential distribution is formed by utilizing the light shielding layer, it is possible to suppress an increase in the number of the steps.

[0085]

(40) In accordance with Claim 40, the present invention relates to the method of manufacturing a matrix type display device according to Claim 29, wherein the potential

distribution is formed so that a region coated with the optical material has polarity opposite to that of a region not coated with the optical material or coated with the optical material during another period of time.

[0086]

In this claim, the effect of improving the patterning precision is further increased by utilizing both electric attraction and repulsion.

[0087]

(41) In accordance with Claim 41, the present invention relates to the method of manufacturing a matrix type display device according to Claim 1, 19 or 29, wherein the optical material is an inorganic or organic fluorescent material.

[0088]

In this claim, since the method of manufacturing a matrix type display device uses an inorganic or organic fluorescent material as the optical material, the patterning precision can be improved.

[0089]

(42) In accordance with Claim 42, the present invention relates to the method of manufacturing a matrix type display device according to Claim 1, 19 or 29, wherein the optical material is a liquid crystal.

[0090]

In this claim, since the method of manufacturing a

matrix type display device uses a liquid crystal as the optical material, the patterning precision can be improved.

[0091]

(43) In accordance with Claim 43, the present invention relates to the method of manufacturing a matrix type display device according to Claim 6, 7, 22, 23, 33 or 34, wherein the switching elements are made of amorphous silicon, polycrystalline silicon formed by a high temperature process at 600°C or more, or polycrystalline silicon formed by a high temperature process at 600°C or less.

[0092]

In this claim, since the method of manufacturing a matrix type display device uses amorphous silicon, polycrystalline silicon formed by a high temperature process at 600°C or more, or polycrystalline silicon formed by a high temperature process at 600°C or. less for the switching elements, the patterning precision can be improved. Particularly, in the use of polycrystalline silicon formed by a low temperature process, both low cost due to use of a glass substrate and high performance due to high mobility can be achieved.

[0093]

[Description of the Embodiment]

Preferred embodiments of the present invention will be described in detail below with reference to the drawings.

[0094]

(1) First embodiment

Fig. 1 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a first embodiment of the present invention.

[0095]

Reference numeral 111 denotes unevenness; reference numeral 114, an organic fluorescent material solution; reference numeral 121, a display substrate; reference numeral 132, a signal line; reference numeral 133, a common line; reference numeral 141, a pixel electrode; reference numeral 151, an insulation film; and reference numeral 115, a difference in height of the unevenness. Fig. 1 is a drawing showing an intermediate state in the course of manufacture, and a reflecting electrode is formed as the uppermost layer at the time of completion. The pixel electrodes 141 are made of ITO. The insulation film 151 has openings formed above the pixel electrodes 141. A current flows between the pixel electrodes 141 and the reflecting electrode to cause the organic fluorescent material to emit light.

[0096]

Fig. 2 is a plan view of a matrix type display device in accordance with the first embodiment of the present invention.

[0097]

Reference numeral 131 denotes a scanning line; a reference numeral 142, a switching thin film transistor; and reference numeral 143, a current thin film transistor. The switching thin film transistor 142 transmits the potential of the signal line 132 to the current thin film transistor 143 according to the potential of the scanning line 131, and the current thin film transistor 143 controls conduction between the common line 133 and the pixel electrode 141.

[0098]

Fig. 3 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the first embodiment of the present invention.

[0099]

First, as shown by reference numeral 211, the scanning lines 131, the signal lines 132, the common lines 133, the pixel electrodes 141, the switching thin film transistors 142, the current thin film transistors 143 and the insulation film 151 are formed on a display substrate. At this time, the signal lines 132 and the common lines 133 are formed thick. Next, as shown by reference numeral 221, the organic fluorescent material solution 114 is selectively coated by an ink jet method for each of pixels. The organic fluorescent material solution 114 is solidified by heating, light irradiation or the like according to demand. Finally,

as shown by reference numeral 231, the reflecting electrode is formed.

[0100]

In this embodiment, as described in Claim 1, the unevenness 111 is formed on the display substrate 121, and the organic fluorescent material solution 114 is coated in correspondence with the unevenness 111. The patterning precision of the organic fluorescent material solution 114 can be improved.

[0101]

In this embodiment, as described in Claim 2, the organic fluorescent material solution 114 is coated in correspondence with the recesses of the unevenness 111 to improve the patterning precision by utilizing gravity and surface tension. Also inertia force such as centrifugal force or the like may be used.

[0102]

As described in Claim 6, this embodiment relates to an active matrix type display device. As described in Claim 4, a passive matrix type display device may be used.

[0103]

In this embodiment, as described in Claim 9, the unevenness 111 is formed by utilizing the signal lines 132 and the common lines 133. As described in Claim 8, 9 or 12, the unevenness 111 may be formed by utilizing the first bus

lines in a passive matrix type display device, and the scanning lines 131 or a light shielding layer in an active matrix type display device.

[0104]

As described in Claim 13, the unevenness 111 may be formed by coating a liquid material. As described in Claim 14, the unevenness 111 may be formed by forming a material on a peeling substrate through a peeling layer and transferring the structure peeled off from the peeling layer on the peeling substrate onto the display substrate.

[0105]

In this embodiment, as described in Claim 15, the difference in height of the unevenness 111 satisfies the following equation (1).

[0106]

Equation (1) $Da < dr$ wherein the symbols represent the following:

Da: coating thickness of the organic fluorescent material solution 114

dr: difference in height of the unevenness 111

The organic fluorescent material solution 114 can be prevented from flowing out to adjacent regions beyond the unevenness 111 in coating of the organic fluorescent material solution 114.

[0107]

In this embodiment, as described in Claim 16, the coating thickness satisfies the following equation (2).

[0108]

Equation (2) $Vd/(da \cdot r) > Et$ wherein the symbols represent the following:

Vd: driving voltage applied to the organic fluorescent material

r: concentration of the organic fluorescent material solution

Et: minimum electric field strength (threshold electric field strength) at which changes in the optical properties of the organic fluorescent material occur

The relation between the coating thickness and the driving voltage is defined, and it is ensured that the organic fluorescent material exhibits an electro-optical effect.

[0109]

As described in Claim 17, the difference in height of the unevenness 111 may satisfy the following equation (3).

[0110]

Equation (3) $df = dr$ wherein the symbols represent the following:

df: thickness of organic fluorescent material at the time of completion

dr: difference in height of the unevenness

The unevenness 111 and the organic fluorescent material securely have flatness, uniformity is obtained in changes in the optical properties of the fluorescent material, and a short circuit can be prevented.

[0111]

The thickness at the time of completion may satisfy the following equation (4).

[0112]

Equation (4) $Vd/df > Et$ wherein the symbols represent the following:

vd: driving voltage applied to the organic fluorescent material

Et: minimum electric field strength (threshold electric field strength) at which changes in the optical properties of the organic fluorescent material occur

The relation between the thickness at the time of completion and the driving voltage is defined, and it is ensured that the organic fluorescent material exhibits an electro-optical effect.

[0113]

In this embodiment, as described in Claim 41, the optical material is an organic fluorescent material. As described in Claim 41 or 42, the optical material may be an inorganic fluorescent material or a liquid crystal.

[0114]

In this embodiment, as described in Claim 43, the switching elements are made of polycrystalline silicon formed by a low temperature process at 600° C or less. Both low cost due to the use of a glass substrate and high performance due to high mobility can be achieved. As described in Claim 43, the switching elements may be made of amorphous silicon or polycrystalline silicon formed by a high temperature process at 600° C or more.

[0115]

In this embodiment, the switching thin film transistors 142 and the current thin film transistors 143 are used. Other types of switching elements may be used, or a single switching element may be used for each of the pixels.

[0116]

Examples of organic fluorescent materials include cyanopolyphenylenevinylene, polyphenylenevinylene, polyalkylphenylene, 2,3,6,7-tetrahydro-11-oxo-1H,5H,11H(1) benzopyrano[6,7,8-ij]-quinolizine-10-carboxylic acid, 1,1-bis-(4-N,N-ditolylaminophenyl) cyclohexane, 2-13',4'-dihydroxyphenyl)-3,5,7-trihydroxy-1-benzopyrylium perchlorate, tris(8-hydroxyquinolinol)aluminum, 2,3,6,7-tetrahydro-9-methyl-11-oxo-1H,5H,11H(1)benzopyrano[6,7,8-ij]-quinolizine, aromatic diamine derivatives (TDP), oxdiazole dimers (OXD), oxdiazole derivatives (PBD), distyryl arylene derivatives (DSA), quinolinol metal

complexes, beryllium-benzoquinolinol complexes (Bebq), triphenylamine derivatives (MTDATA), distyryl derivatives, pyrazoline dimers, rubrene, quinacridone, triazole derivatives, polyphenylene, polyalkylfluorene, polyalkylthiphene, azomethine zinc complexes, porphyrin zinc complexes, benzoxazole zinc complexes, phenanthroline europium complexes, and the like.

[0117]

A hole injection material may be formed. Examples of the hole injection material include polyphenylenevinylene formed from polytetrahydrothiophenylphenylene as a polymer precursor, 1,1-bis-(4-N,N-ditolylaminophenyl)cyclohexane, tris(8-hydroxyquinolinol) aluminum, and the like.

[0118]

(2) Second embodiment

Fig. 4 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a second embodiment of the present invention. Fig. 4 is a drawing showing a state in the course of manufacture, and a reflecting electrode is formed as the uppermost layer at the time of completion. Although, in the first embodiment, the surface of the display substrate 121 on which each structure is formed is turned upward, in this embodiment, the surface of the display substrate 121 on which each structure is formed is turned downward.

[0119]

Fig. 5 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the second embodiment of the present invention.

[0120]

First, as shown by reference numeral 212, the scanning lines 131, the signal lines 132, the common lines 133, the pixel electrodes 141, the switching thin film transistors 142, the current thin film transistors 143 and the insulation film 151 are formed on the display substrate 121. At this time, the pixel electrode 141 are formed thick. Next, as shown by reference numeral 222, the organic fluorescent material solution 114 is selectively coated by the ink jet method for each of the pixels. The organic fluorescent material solution 114 is solidified by heating, light irradiation or the like according to demand. Finally, as shown by reference numeral 231, the reflecting electrode is formed.

[0121]

In this embodiment, as described in Claim 3, the organic fluorescent material solution 114 is coated in correspondence with the protrusions of the unevenness 111 to improve the patterning precision by utilizing gravity and surface tension. Also inertia force such as centrifugal force or the like may be used.

[0122]

(3) Third embodiment

Fig. 6 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a third embodiment of the present invention.

[0123]

Reference numeral 122 denotes a peeling substrate; reference numeral 152, a peeling layer; reference numeral 153, an organic fluorescent material; and reference numeral 154, a reflecting electrode.

[0124]

Fig. 7 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the third embodiment of the present invention.

[0125]

First, as shown by reference numeral 213, the reflecting electrode 154 is formed on the display substrate 121. Next, as shown by reference numeral 214, the unevenness 111 is formed. Then, as shown by reference numeral 221, the organic fluorescent material solution 114 is selectively coated by the ink jet method for each of the pixels. The organic fluorescent material solution 114 is solidified by heating, light irradiation or the like according to demand to form the organic fluorescent material 153. Then, as shown by reference numeral 241, the scanning

lines 131, the signal lines 132, the common lines 133, the pixel electrodes 141, the switching thin film transistors 142, the current thin film transistors 143 and the insulation film 151 are formed on the peeling substrate 122 through the peeling layer 152. Finally, as shown by reference numeral 242, the structure peeled off from the peeling layer 122 on the peeling substrate 122 is transferred onto the display substrate 121.

[0126]

In this embodiment, it is possible to decrease damage to the base material such as the organic fluorescent material 153 or the like in later steps, or damage to the scanning lines 131, the signal lines 132, the pixel electrodes 141, the switching thin film transistors 142, the current thin film transistors 143 or the insulation film 151 due to coating of the optical material or the like.

[0127]

As described in Claim 7, this embodiment relates to an active matrix type display device. However, a passive matrix type display device may be used.

[0128]

(4) Fourth embodiment

Fig. 8 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a fourth embodiment of the present invention.

[0129]

Fig. 9 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the fourth embodiment of the present invention.

[0130]

First, as shown by reference numeral 215, the scanning lines 131, the signal lines 132, the common lines 133, the pixel electrodes 141, the switching thin film transistors 142, the current thin film transistors 143 and the insulation film 151 are formed on the display substrate. At this time, the insulation film 151 is formed thick. Next, as shown by reference numeral 221, the organic fluorescent material solution 114 is selectively coated by the ink jet method for each of the pixels. The organic fluorescent material solution 114 is solidified by heating, light irradiation or the like according to demand to form the organic fluorescent material 153. Finally, as shown by reference numeral 231, the reflecting electrode is formed.

[0131]

In this embodiment, as described in Claim 11, the unevenness 111 is formed by utilizing the insulation film 151. Since the unevenness 111 is formed by utilizing the insulation film 151, an increase in the number of the steps can be prevented.

[0132]

(5) Fifth embodiment

Fig. 10 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a fifth embodiment of the present invention.

[0133]

Reference numeral 112 denotes a distribution of water repellency and hydrophilicity, and reference numeral 155 denotes an amorphous silicon layer. Since the amorphous silicon layer 155 is relatively water-repellent, the distribution of water repellency and hydrophilicity is formed.

[0134]

Fig. 11 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the fifth embodiment of the present invention.

[0135]

First, as shown by reference numeral 216, the scanning lines 131, the signal lines 132, the common lines 133, the pixel electrodes 141, the switching thin film transistors 142, the current thin film transistors 143 and the insulation film 151 are formed on the display substrate. Next, as shown by reference numeral 217, the amorphous silicon layer 155 is formed to form the distribution 112 of water repellency and hydrophilicity. Then, as shown by reference numeral 221, the organic fluorescent material

solution 114 is selectively coated by the ink jet method for each of the pixels. The organic fluorescent material solution 114 is solidified by heating, light irradiation or the like according to demand to form the organic fluorescent material 153. Finally, as shown by reference numeral 231, the reflecting electrode is formed.

[0136]

In this embodiment, as described in Claim 19, the distribution 112 of water repellency and hydrophilicity is formed on the display substrate 121, and the organic fluorescent material solution 114 is coated in correspondence with the distribution 112 of water repellency and hydrophilicity. Therefore, the patterning precision of the organic fluorescent material solution 114 can be improved.

[0137]

As described in Claim 22, this embodiment relates to an active matrix type display device. However, a passive matrix type display device may be used.

[0138]

As described in Claims 21 and 23, the method may further comprise the step of transferring the structure formed on the peeling substrate 121 through the peeling layer 152 onto the display substrate 121.

[0139]

In this embodiment, the distribution 112 of water repellency and hydrophilicity is formed by utilizing the amorphous silicon layer 155. The distribution 112 of water repellency and hydrophilicity may be formed by utilizing a metal, an anodic oxide film, an insulation film of polyimide or silicon oxide, or another material. As described in Claim 24, 25, 26, 27 or 28, the distribution 112 of water repellency and hydrophilicity may be formed by utilizing the first bus lines in a passive matrix type display device, and the scanning lines 131, the signal lines 132, the pixel electrodes 141, the insulation film 151 or the light shielding layer in an active matrix type display device.

[0140]

In this embodiment, an aqueous solution is coated in correspondence with the distribution 112 of water repellency and hydrophilicity. However, another liquid solution may be used and coated in correspondence with a distribution of liquid repellency and lyophilicity for the solution.

[0141]

(6) Sixth embodiment

Fig. 12 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a sixth embodiment of the present invention.

[0142]

Reference numeral 113 denotes a potential distribution.

[0143]

Fig. 13 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the sixth embodiment of the present invention.

[0144]

First, as shown by reference numeral 216, the scanning lines 131, the signal lines 132, the common lines 133, the pixel electrodes 141, the switching thin film transistors 142, the current thin film transistor 143 and the insulation film 151 are formed on the display substrate. Next, as shown by reference numeral 218, the potential distribution 113 is formed by driving. Then, as shown by reference numeral 223, the charged organic fluorescent material solution 114 is selectively coated by the ink jet method for each of the pixels. The organic fluorescent material solution 114 is solidified by heating, light irradiation or the like according to demand to form the organic fluorescent material 153. Finally, as shown by reference numeral 241, the reflecting electrode is formed.

[0145]

In this embodiment, as described in Claim 29, the potential distribution 113 is formed on the display substrate 121, and the organic fluorescent material solution 114 is coated in correspondence with the potential distribution 113. Therefore, the pattering precision of

the organic fluorescent material solution 114 can be improved.

[0146]

In this embodiment, as described in Claim 30, the organic fluorescent material solution 114 is charged. The effect of improving the patterning precision is further improved by utilizing not only spontaneous polarization but also electric charge.

[0147]

As described in Claim 33, this embodiment relates to an active matrix type display device. However, as described in Claim 31, a passive matrix type display device may be used.

[0148]

As described in Claims 32 and 34, the method may further comprise the step of transferring the structure formed on the peeling substrate 121 through the peeling layer 152 onto the display substrate 121.

[0149]

In this embodiment, as described in Claims 36, 37 and 38, the potential distribution 112 is formed by successively applying a potential to the scanning lines 131, and at the same time applying a potential to the signal lines 132 and the common lines 133, and applying a potential to the pixel electrodes 141 through the switching thin film transistors

142 and the current thin film transistors 143. Since the potential distribution is formed by utilizing the scanning lines 131, the signal lines 132, the common lines 133 and the pixel electrode 141, an increase in the number of the steps can be prevented. As described in Claim 35 or 39, the potential distribution may be formed by utilizing the first bus lines or the light shielding layer in a passive matrix type display device.

[Brief Description of the Drawings]

[Fig. 1]

Fig. 1 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a first embodiment of the present invention.

[Fig. 2]

Fig. 2 is a plan view of a matrix type display device in accordance with the first embodiment of the present invention.

[Fig. 3]

Fig. 3 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the first embodiment of the present invention.

[Fig. 4]

Fig. 4 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a second embodiment of the present invention.

[Fig. 5]

Fig. 5 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the second embodiment of the present invention.

[Fig. 6]

Fig. 6 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a third embodiment of the present invention.

[Fig. 7]

Fig. 7 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the third embodiment of the present invention.

[Fig. 8]

Fig. 8 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a fourth embodiment of the present invention.

[Fig. 9]

Fig. 9 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the fourth embodiment of the present invention.

[Fig. 10]

Fig. 10 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a fifth embodiment of the present invention.

[Fig. 11]

Fig. 11 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the fifth embodiment of the present invention.

[Fig. 12]

Fig. 12 is a sectional view showing a method of manufacturing a matrix type display device in accordance with a sixth embodiment of the present invention.

[Fig. 13]

Fig. 13 is a drawing showing the steps of the method of manufacturing a matrix type display device in accordance with the sixth embodiment of the present invention.

[Reference Numerals]

111: unevenness

112: distribution of water repellency and hydrophilicity

113: potential distribution

114: organic fluorescent material solution

115: difference in height of unevenness

121: display substrate

122: peeling substrate

131: scanning line

132: signal line

133: common line

141: pixel electrode

142: switching thin film transistor

143: current thin film transistor

151: insulation film

152: peeling layer

153: organic fluorescent material

154: reflecting electrode

155: amorphous silicon layer

211: Form scanning lines, signal lines, common lines, pixel electrodes, thin film transistors, and an insulation film on a display substrate. At this time, the signal lines and the common lines are formed thick.

212: Form scanning lines, signal lines, common lines, pixel electrodes, thin film transistors, and an insulation film on a display substrate. At this time, the pixel electrodes are formed thick.

213: Form a reflecting electrode on the display substrate.

214: Form unevenness on the display substrate.

215: Form scanning lines, signal lines, common lines, pixel electrodes, thin film transistors, and an insulation film on a display substrate. At this time, the insulation film is formed thick.

216: Form scanning lines, signal lines, common lines, pixel electrodes, thin film transistors, and an insulation film on a display substrate.

217: Form an amorphous silicon layer to form a

distribution of water repellency and hydrophilicity.

218: Form a potential distribution by driving.

221: Selectively coat an organic fluorescent material solution by ink jet.

222: Selectively coat an organic fluorescent material solution on the lower side by ink jet.

223: Form a reflecting electrode.

241: Form scanning lines, signal lines, common lines, pixel electrodes, thin film transistors, and an insulation film on a peeling substrate through a peeling layer.

242: Transfer the structure peeled off from the peeling film on the peeling substrate onto the display substrate.

[Name of Document] ABSTRACT

[ABSTRACT]

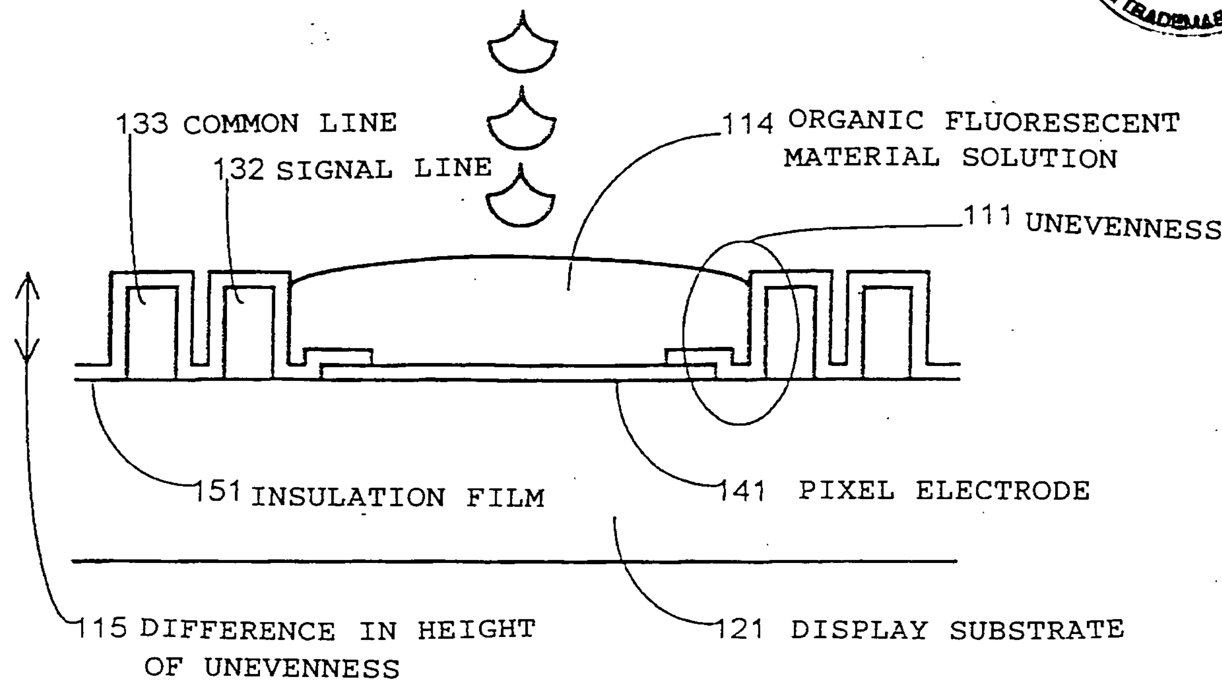
[Object] To improve patterning precision in a method of manufacturing a matrix type display device while maintaining properties such as low cost, high throughput and the high degree of freedom of an optical material, etc.

[Solving Means] On a display substrate is formed unevenness, a distribution of liquid repellency and lyophilicity or a potential distribution by utilizing first bus lines of a passive matrix type display device or scanning lines, signal lines, common lines, pixel electrodes, an insulation film, a light shielding layer, or another component of an active matrix type display device. A liquid optical material is coated in correspondence with the unevenness, distribution of liquid repellency and lyophilicity or potential distribution.

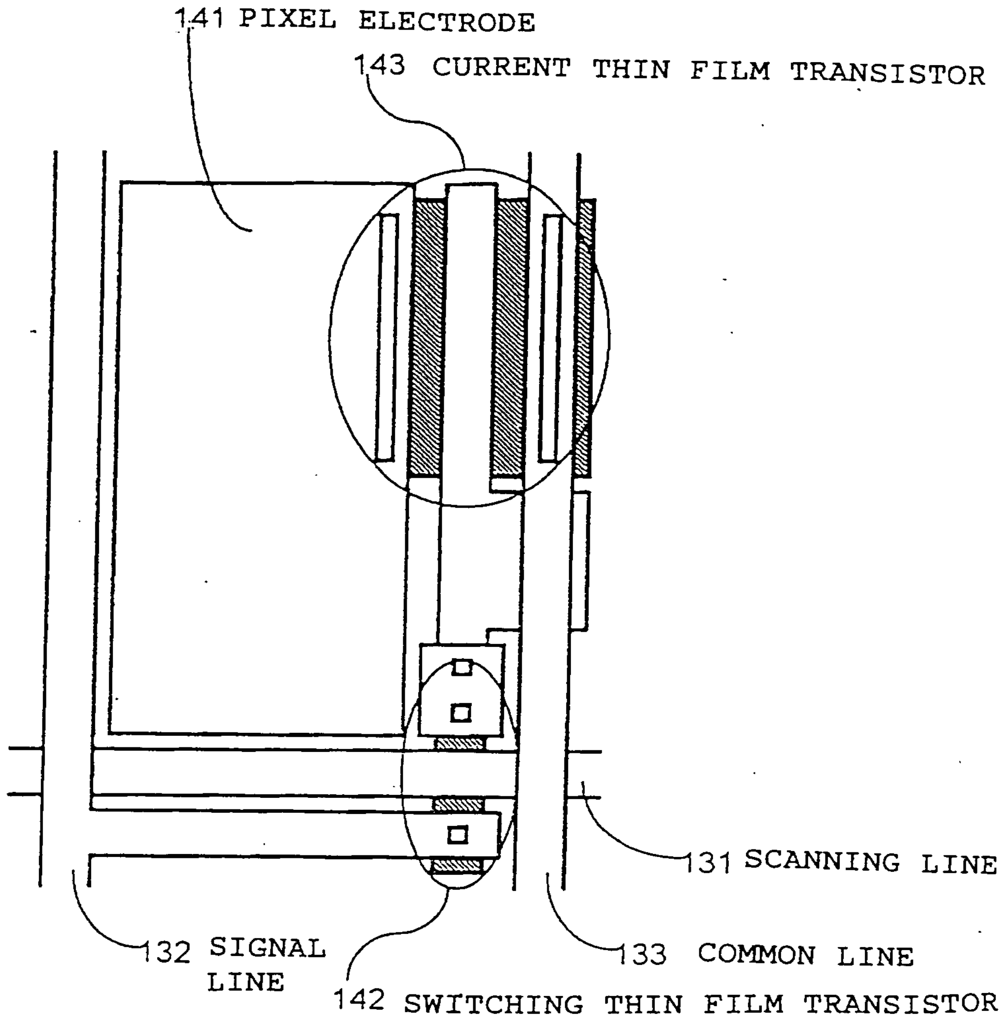
[Selected Figure] Fig. 1

[Name of Document] DRAWINGS

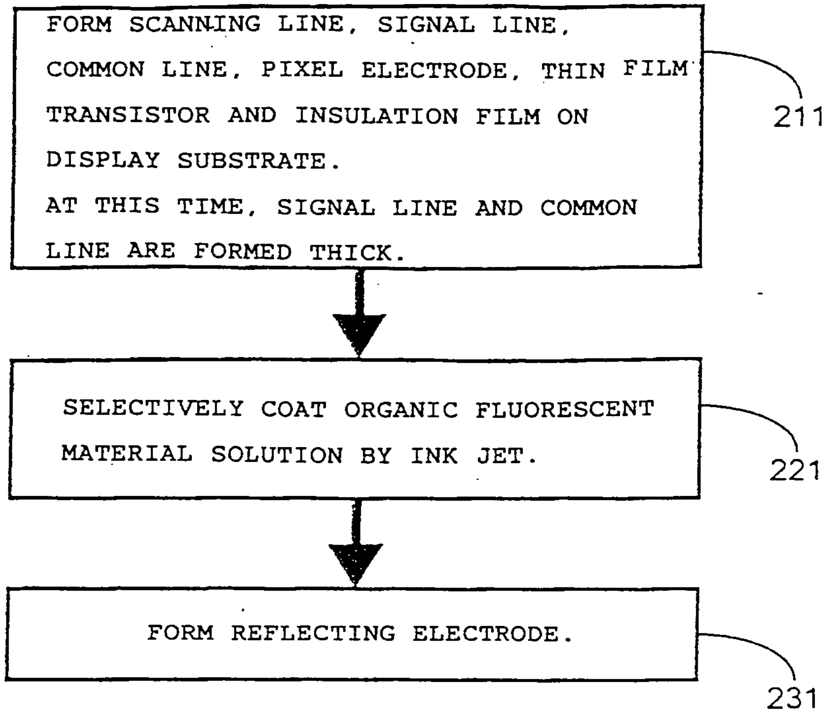
[FIG. 1]



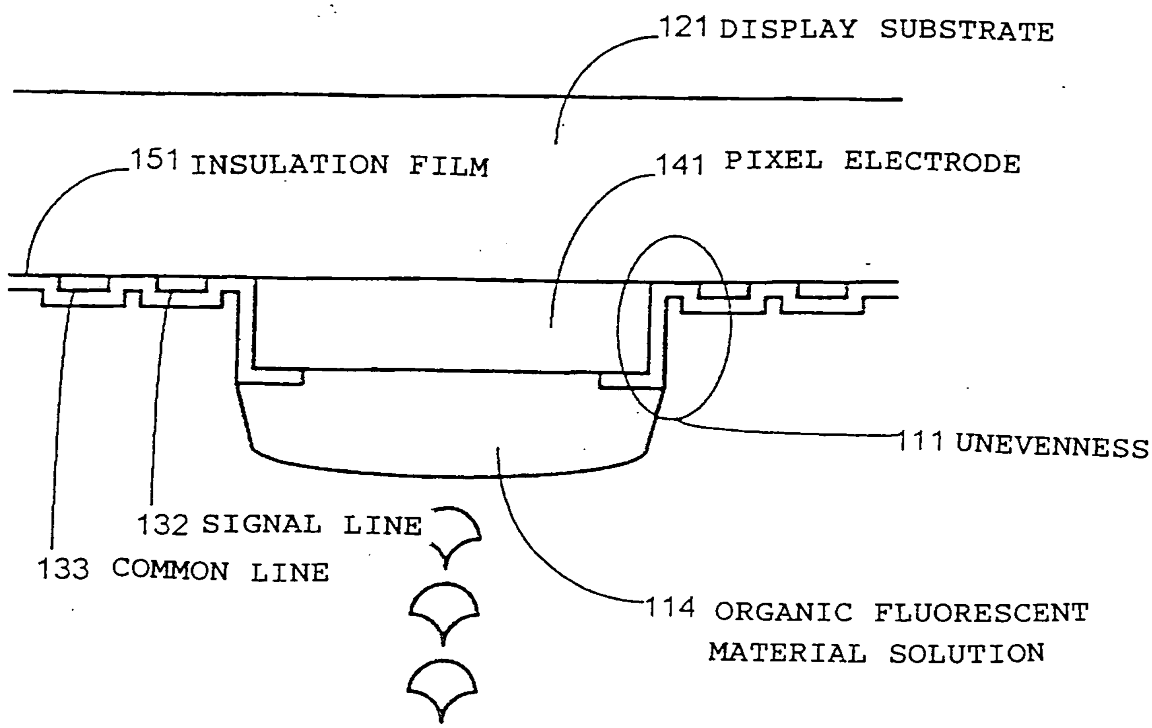
[FIG. 2]


141 PIXEL ELECTRODE
143 CURRENT THIN FILM TRANSISTOR
131 SCANNING LINE
132 SIGNAL LINE
133 COMMON LINE
142 SWITCHING THIN FILM TRANSISTOR

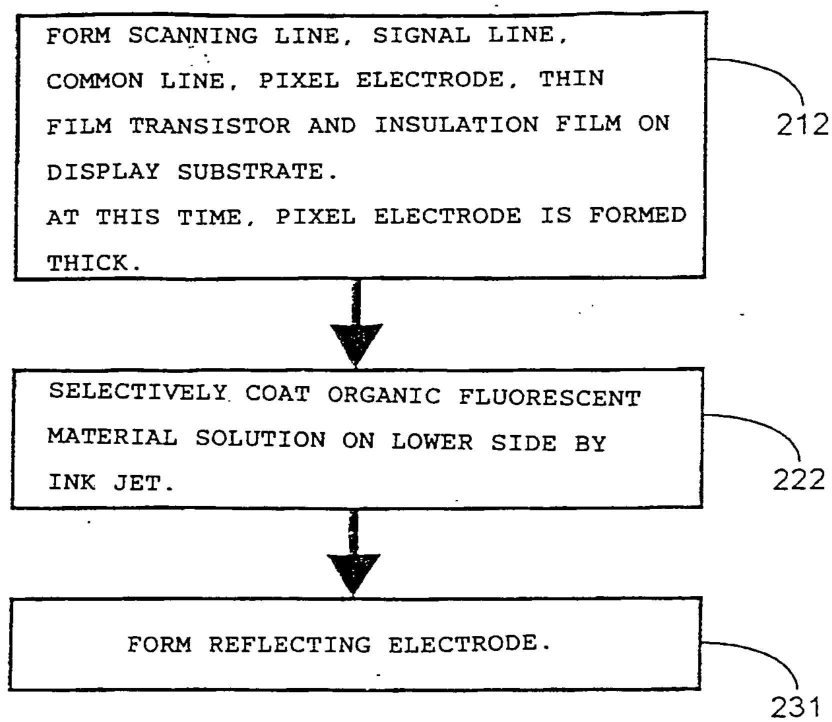
[FIG. 3]


FORM SCANNING LINE, SIGNAL LINE, COMMON LINE, PIXEL ELECTRODE, THIN FILM TRANSISTOR AND INSULATION FILM ON DISPLAY SUBSTRATE.
AT THIS TIME, SIGNAL LINE AND COMMON LINE ARE FORMED THICK.
211
SELECTIVELY COAT ORGANIC FLUORESCENT MATERIAL SOLUTION BY INK JET.
221
FORM REFLECTING ELECTRODE.
231

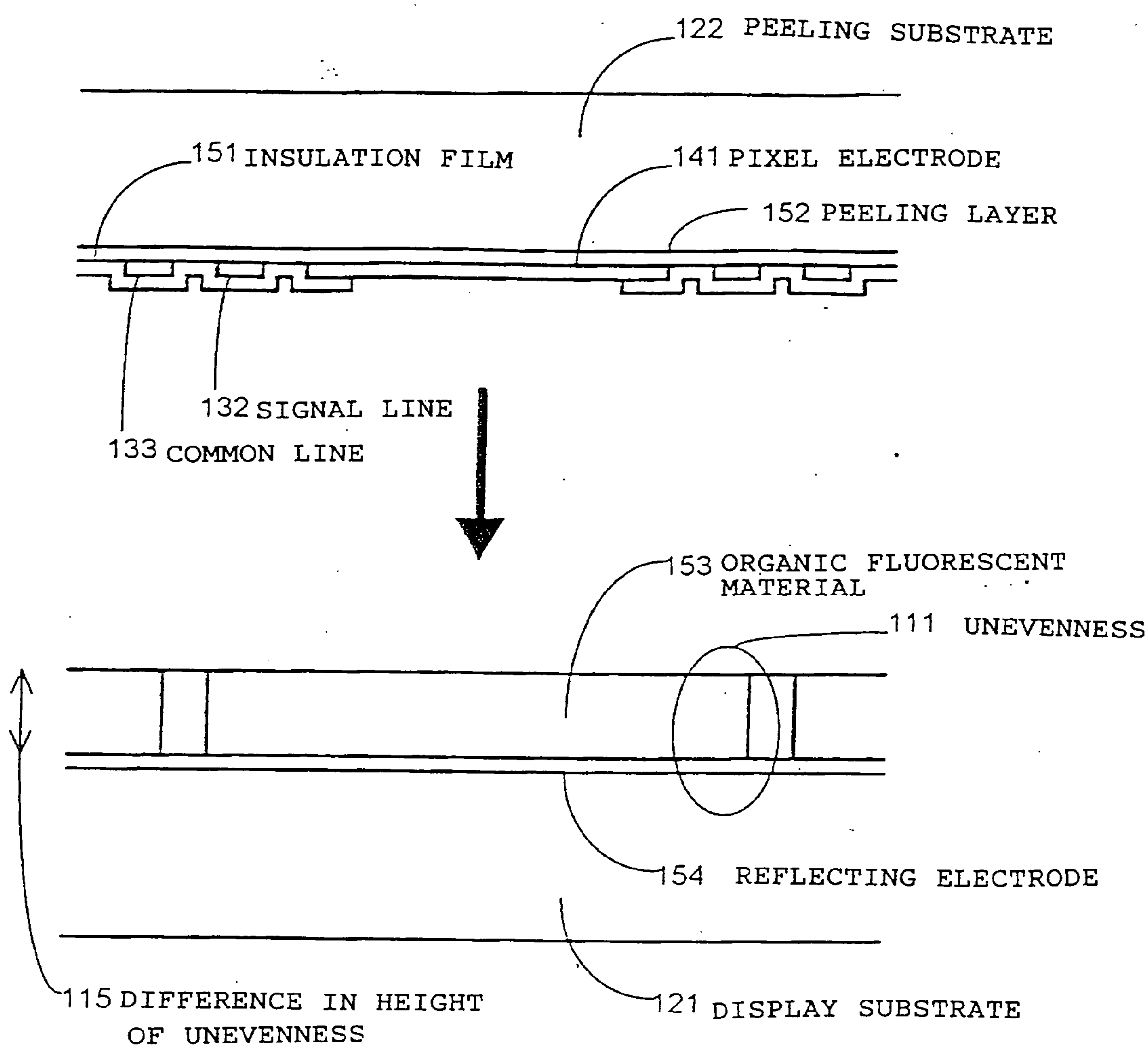
[FIG. 4]


121 DISPLAY SUBSTRATE
151 INSULATION FILM
141 PIXEL ELECTRODE
111 UNEVENNESS
132 SIGNAL LINE
133 COMMON LINE
114 ORGANIC FLUORESCENT MATERIAL SOLUTION

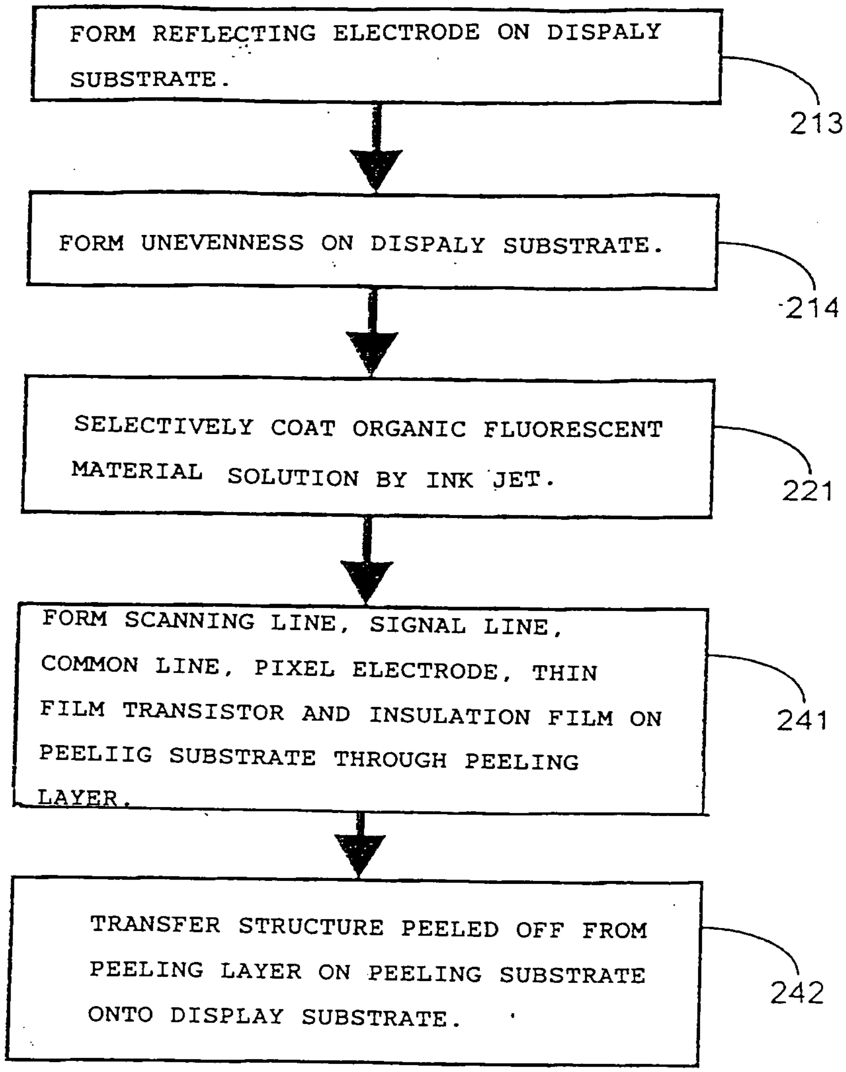
[FIG. 5]


FORM SCANNING LINE, SIGNAL LINE, COMMON LINE, PIXEL ELECTRODE, THIN FILM TRANSISTOR AND INSULATION FILM ON DISPLAY SUBSTRATE.
AT THIS TIME, PIXEL ELECTRODE IS FORMED THICK.
212
SELECTIVELY COAT ORGANIC FLUORESCENT MATERIAL SOLUTION ON LOWER SIDE BY INK JET.
222
FORM REFLECTING ELECTRODE.
231

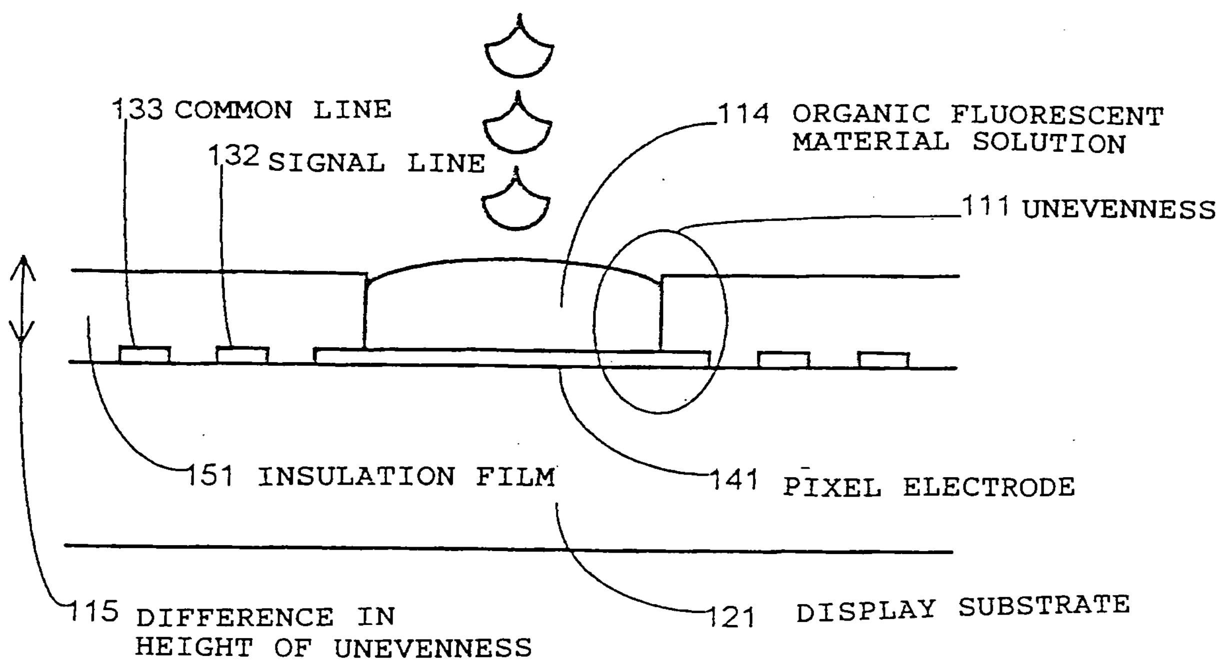
[FIG. 6]


122 PEELING SUBSTRATE
151 INSULATION FILM
141 PIXEL ELECTRODE
152 PEELING LAYER
132 SIGNAL LINE
133 COMMON LINE
153 ORGANIC FLUORESCENT MATERIAL
111 UNEVENNESS
154 REFLECTING ELECTRODE
115 DIFFERENCE IN HEIGHT OF UNEVENNESS
121 DISPLAY SUBSTRATE

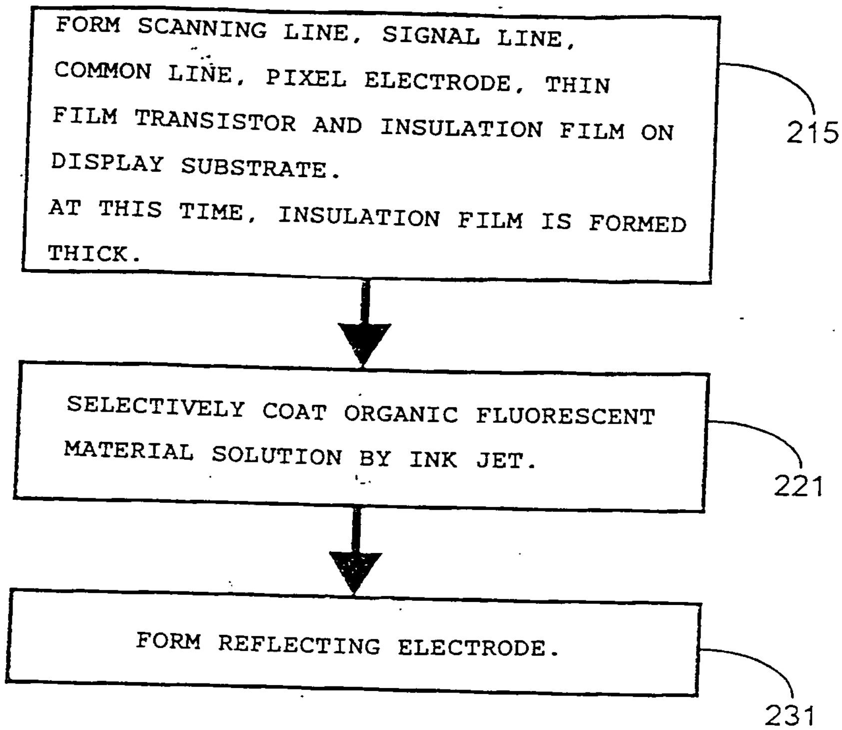
[FIG. 7]


FORM REFLECTING ELECTRODE ON DISPALY SUBSTRATE.
213
FORM UNEVENNESS ON DISPALY SUBSTRATE.
214
SELECTIVELY COAT ORGANIC FLUORESCENT MATERIAL SOLUTION BY INK JET.
221
FORM SCANNING LINE, SIGNAL LINE, COMMON LINE, PIXEL ELECTRODE, THIN FILM TRANSISTOR AND INSULATION FILM ON PEELIIG SUBSTRATE THROUGH PEELING LAYER.
241
TRANSFER STRUCTURE PEELED OFF FROM PEELING LAYER ON PEELING SUBSTRATE ONTO DISPLAY SUBSTRATE.
242

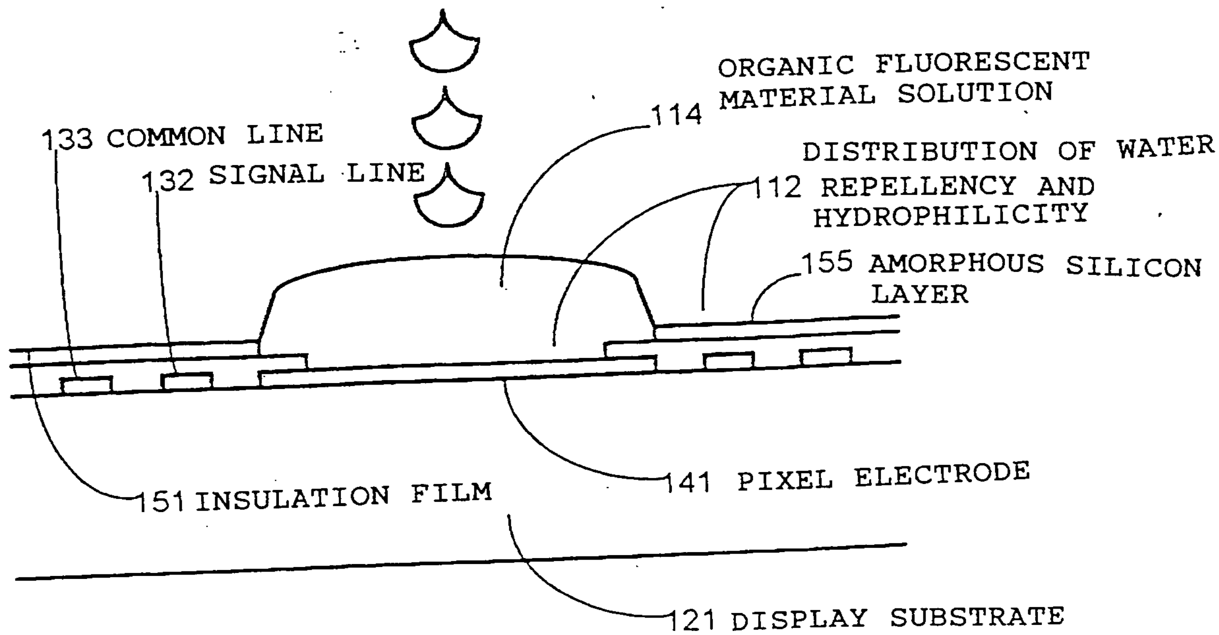
[FIG. 8]


133 COMMON LINE
132 SIGNAL LINE
114 ORGANIC FLUORESCENT MATERIAL SOLUTION
111 UNEVENNESS
151 INSULATION FILM
141 PIXEL ELECTRODE
115 DIFFERENCE IN HEIGHT OF UNEVENNESS
121 DISPLAY SUBSTRATE

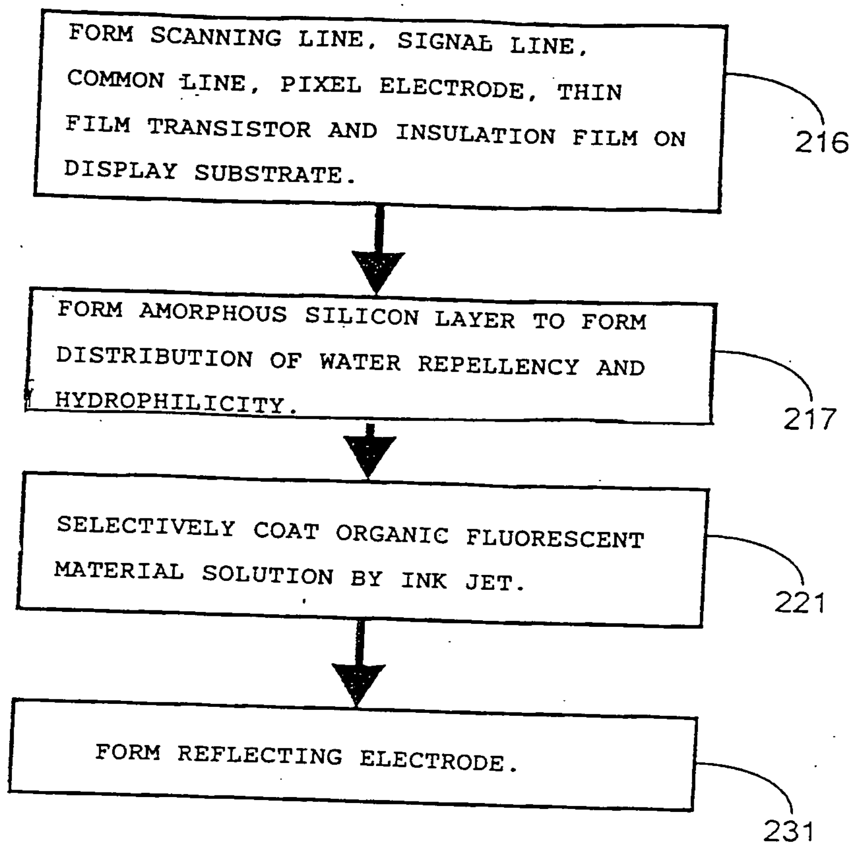
[FIG. 9]


FORM SCANNING LINE, SIGNAL LINE, COMMON LINE, PIXEL ELECTRODE, THIN FILM TRANSISTOR AND INSULATION FILM ON DISPLAY SUBSTRATE.
AT THIS TIME, INSULATION FILM IS FORMED THICK.
215
SELECTIVELY COAT ORGANIC FLUORESCENT MATERIAL SOLUTION BY INK JET.
221
FORM REFLECTING ELECTRODE.
231

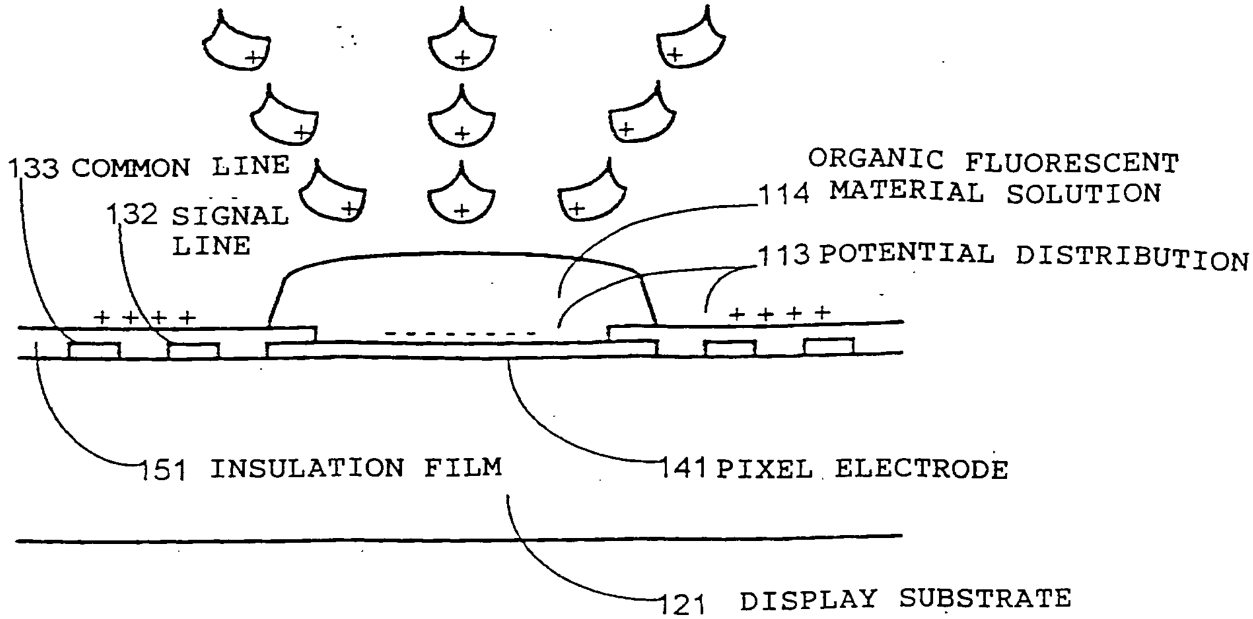
[FIG. 10]


114 ORGANIC FLUORESCENT MATERIAL SOLUTION
133 COMMON LINE
132 SIGNAL LINE
112 DISTRIBUTION OF WATER REPELLENCY AND HYDROPHILICITY
155 AMORPHOUS SILICON LAYER
151 INSULATION FILM
141 PIXEL ELECTRODE
121 DISPLAY SUBSTRATE

[FIG. 11]

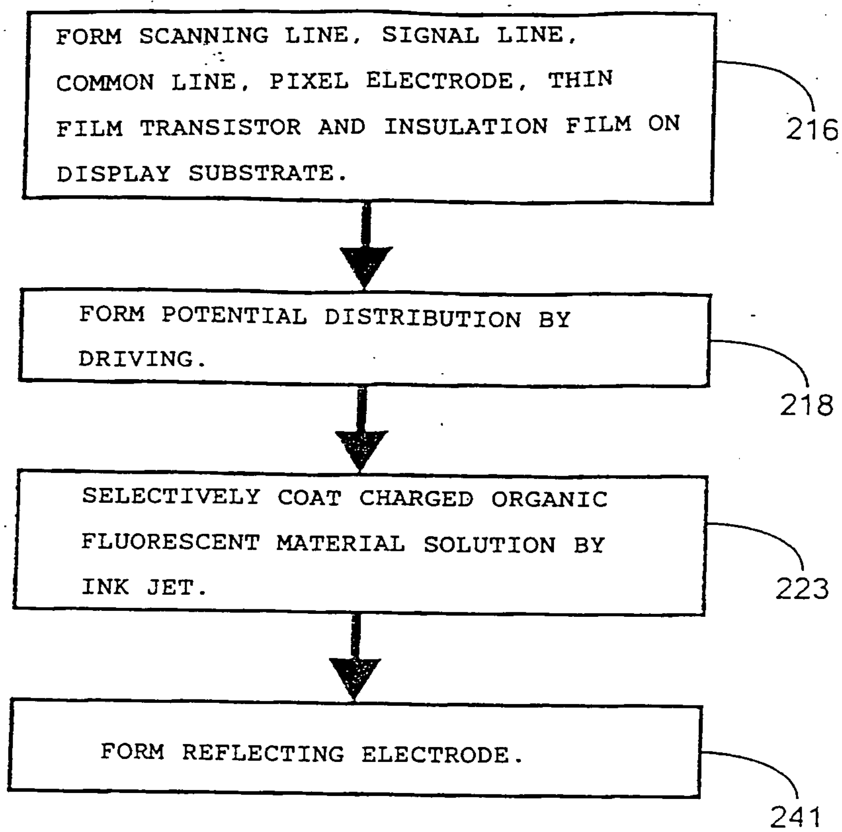

FORM SCANNING LINE, SIGNAL LINE, COMMON LINE, PIXEL ELECTRODE, THIN FILM TRANSISTOR AND INSULATION FILM ON DISPLAY SUBSTRATE.
216
FORM AMORPHOUS SILICON LAYER TO FORM DISTRIBUTION OF WATER REPELLENCY AND HYDROPHILICITY.
217
SELECTIVELY COAT ORGANIC FLUORESCENT MATERIAL SOLUTION BY INK JET.
221
FORM REFLECTING ELECTRODE.
231

[FIG. 12]



133 COMMON LINE
132 SIGNAL LINE
ORGANIC FLUORESCENT
114 MATERIAL SOLUTION
113 POTENTIAL DISTRIBUTION
151 INSULATION FILM
141 PIXEL ELECTRODE
121 DISPLAY SUBSTRATE

[FIG. 13]


FORM SCANNING LINE, SIGNAL LINE, COMMON LINE, PIXEL ELECTRODE, THIN FILM TRANSISTOR AND INSULATION FILM ON DISPLAY SUBSTRATE.
216
FORM POTENTIAL DISTRIBUTION BY DRIVING.
218
SELECTIVELY COAT CHARGED ORGANIC FLUORESCENT MATERIAL SOLUTION BY INK JET.
223
FORM REFLECTING ELECTRODE.
241